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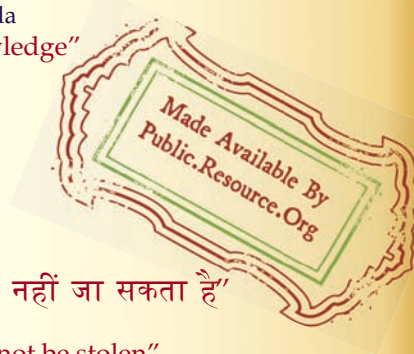
IS 12997-1 (1989): Television Signal Booster, Part 1: Wide Band, VHF Range [LITD 7: Audio, Video and Multimedia Systems and Equipment]



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Indian Standard

TELEVISION SIGNAL BOOSTER — SPECIFICATION

PART 1 WIDE BAND, VHF RANGE

UDC 621'319'837 : 621'397'13

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BUREAU OF INDIAN STANDARDS
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NEW DELHI 110002

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Price Group 3

FOREWORD

This Indian Standard (Part 1) was adopted by the Bureau of Indian Standards on 12 December 1989, after the draft finalized by the Radio Communication Sectional Committee had been approved by the Electronics and Telecommunication Division Council.

The object of this standard is to lay down the general and performance requirements for television signal boosters. The limits of performance have been so chosen as to give general guidance to the manufacturers of the boosters and at the same time ensure sufficient freedom in their design.

Other parts likely to be covered in this series would cover requirements for tuned boosters and boosters in the VHF range.

The normal TV transmission is expected to conform to International Radio Consultative Committee (CCIR) norms. As such it ensures proper reception in the target areas (as defined by CCIR) of the transmission without the use of booster. The use of boosters in areas beyond the target areas specified may help in reception but does not necessarily ensure the reception of a signal of optimum quality.

The requirements of the following parameters, although considered essential to adequately define the performance of television signal boosters, are under consideration due to lack of data and would be included subsequently in this specification with the built up of expertise:

- a) Amplitude distortion,
- b) Group delay, and
- c) Cross-modulation.

Indian Standard

TELEVISION SIGNAL BOOSTER — SPECIFICATION

PART 1 WIDE BAND, VHF RANGE

1 SCOPE

1.1 This standard (Part 1) covers general and performance requirements and test methods for wide band television signal boosters in VHF range (Band I or Band III or Band I and Band III).

2 REFERENCES

2.1 The Indian Standards listed in Annex A are necessary adjuncts to this standard.

3 TERMINOLOGY

3.1 For the purpose of this standard, the terms and definitions covered in IS 1885 (Part 3/Sec 2) : 1966 shall apply.

4 GENERAL REQUIREMENTS

4.1 Impedance (Input and Output)

The input impedance shall be 300Ω balanced. The output impedance shall be 300Ω balanced or 75Ω unbalanced. The voltage standing wave ratio (VSWR) (input and output) shall be less than or equal to 3.5 for all the channels.

4.2 Controls

Following controls consistent with ease of operation and maintenance shall be provided:

- a) ON/OFF switch, and
- b) Gain control (optional).

NOTES

1 ON/OFF mode of the amplifier shall be clearly indicated and provision shall be made to have visual indication of the 'ON' mode.

2 When the switch is in the 'OFF' position, the power supply line shall be disconnected.

4.3 Power Supply Requirements

4.3.1 The power supply unit shall be designed to

operate on mains supply specified below:

- a) Nominal mains : 240 V, 50 Hz $\pm$ 2 per-cent
voltage
- b) Limits of mains : 180 to 250 V
voltage
- c) Power Consumption : 1) For booster alone —
shall not exceed 3W.
2) For booster and
power supply unit —
shall not exceed
5 VA.

4.3.2 If the booster is designed to operate from external dc supply, suitable provision for the same shall be provided. The upper limit for the dc voltage shall not exceed 24 V.

4.4 Safety Requirements

The safety requirements shall conform to the applicable requirements of IS 616 : 1986 in general and at least in respect of the following tests:

- a) Leakage current,
- b) Insulation resistance, and
- c) High voltage.

In case the booster and its power supply are housed in separate unit, the tests shall be carried out only for that unit which operates from 240 V, 50 Hz mains supply.

5 PERFORMANCE REQUIREMENTS

5.1 Electrical Requirements

The electrical requirements shall be as specified in Table 1.

5.2 Environmental and Climatic Requirements

These shall be as specified in Table 2.

Table 1 Electrical Requirements
(Clauses 5.1, 5.2 and 5.3)

Sl No.	Parameter	Requirements
i)	Frequency range	Band I and/or Band III
ii)	Power gain	The gain shall be not less than 20 dB at nominal voltage at maximum gain position and shall be within ± 3 dB of the nominal gain specified by the manufacturer at nominal voltage and maximum gain position
iii)	Maximum output level	Less than -10 dB (mW) at maximum gain position and nominal mains voltage
iv)	Noise figure	Band I, 5 dB or less Band III and Band I and III : 6 dB or less
v)	Gain stability	There shall be no self-oscillation at any setting of the gain control under the specified termination

Table 2 Environmental and Climatic Tests
(Clause 5.2)

Sl No.	Test	Severity	In Accordance with
i)	Vibration	10-55 Hz, 0.75 mm, 2 h	IS 9000 (Part 8) : 1984
ii)	Bump	1 000 bumps, 400 m/s ²	IS 9000 (Part 7/Sec 2) : 1979
iii)	Dust test	At 40±2°C, RH not more than 80 percent, 4 h; Recovery period, 2 h	IS 9000 (Part 12) : 1981
iv)	Drop test	No. of drops, 6 Height of drop, 25 mm	IS 9000 (Part 7/Sec 3) : 1979
v)	Salt mist test	At a temperature of -35°C Duration, 2 h	IS 9000 (Part 11) : 1983
vi)	Climatic sequence		
	a) Dry heat	55°C for 16 h Recovery period, 2 h	IS 9000 (Part 3/Sec 5) : 1977
	b) Damp heat (cyclic) (first cycle)	At 40°C and 95 percent RH	IS 9000 (Part 5/Sec 1) : 1981
	c) Cold	-10°C for 2 h Recovery period, 2 h No. of cycles, one	IS 9000 (Part 2/Sec 4) : 1977
	d) Damp heat (cyclic) (remaining cycles)	40°C, 95 percent RH Recovery time, 2 h	IS 9000 (Part 5/Sec 1) : 1981
vii)	Rapid change of temperature	At 55°C for 3 h, -10°C for 5 minutes No. of cycles, 5 Recovery period, 2 h	IS 9000 (Part 14/Sec 1) : 1978
viii)	Rain test	The test shall be carried out for outdoor boosters only and with the rain cover	IS 9000 (Part 16) : 1983
ix)	Operating temperature range test	-10 to +55°C	

5.2.1 After each of the environmental tests listed in Table 2 [except Sl No. (ix)] and after climatic sequence test, following tests shall be carried out and shall meet the requirements specified below:

- | | | |
|-----------------------|--|----------------------------|
| a) Visual examination | } The requirements specified in Table 1 and 4.4 (for safety tests) shall be met with | — There shall be no damage |
| b) Power gain | | |
| c) Noise figure | | |
| d) Safety tests | | |

5.2.2 For operating temperature range, the requirement shall be: 'The booster gain shall not fall by more than 6 dB on any channel with respect to the gain at 25 ± 2°C at the operating temperature extremes'.

5.3 Operating Life Test

The television signal booster shall be subjected to operating life test consisting of 5 hours operation and 1 hour rest period for total operating period of 1 000 hours under laboratory atmospheric conditions and at rated voltage. At the end of the operating life duration, the following tests shall be carried out and the requirements specified in Table 1 and 4.1 (for VSWR) shall be met with:

- Visual examination,
- Power gain,
- Noise figure, and
- Voltage standing wave ratio (VSWR).

6 MARKING

6.1 Each television signal booster shall be legibly and indelibly marked with the following information:

- Indication of the source of manufacture,
- Model designation and Sl No.,
- Input/output impedance,
- Power gain,
- Frequency range, and
- Country of origin.

7 TESTS

7.1 General Conditions of Measurements

7.1.1 Unless specified otherwise, all the measurements shall be carried out under the following ambient conditions:

- Temperature : 15 to 35°C
- Relative humidity : 45 to 75 percent
- Air pressure : 860 to 1 060 m bar
- Input signal level : -70 dB (mW)

7.1.2 Referee Conditions

In cases where the characteristics are sensitive to ambient conditions, the following referee conditions shall be maintained during the measurements:

- Temperature : 25 ± 1°C
- Relative humidity : 65 ± 2 percent
- Air pressure : 860 to 1 060 m bar

7.1.3 In Annex B, a list of essential test equipment for measurements on television signal boosters is given for information and guidance.

7.2 Classification of Tests

7.2.1 Type Tests

The tests specified in Table 3 shall constitute type tests.

Table 3 Type Tests
(Clauses 7.2.1 and 7.2.1.1)

Sl No. (1)	Test (2)	Clause Number (3)
i)	Check for general requirements	4
ii)	Tests for electrical requirements	5.1
iii)	Tests for environmental and climatic requirements	5.2
iv)	Check for marking requirements	6

7.2.1.1 Number of samples

For type tests, three samples shall be selected preferably at random from a regular production lot and shall be subjected to the tests of Table 3.

7.2.1.2 Criteria of acceptance

There shall be no single failure in any of the type tests. In case of failure, twice the number of samples shall be taken and subjected to the tests in which failure has occurred and other tests that have bearing on the test results. No failure shall be permitted in the retests.

7.2.2 Routine Tests

The following shall constitute the routine tests:

- a) Visual examination,
- b) Power gain,
- c) Maximum output level, and
- d) Safety tests:
 - 1) Leakage current,
 - 2) Insulation resistance, and
 - 3) High voltage.

7.2.3 Acceptance Tests

The following shall constitute the acceptance tests and shall be carried out on boosters that have successfully passed the routine tests:

- a) Visual examination,
- b) VSWR, and
- c) Noise figure.

7.2.3.1 A recommended sampling plan and acceptance criteria is given in Annex C.

7.3 Test Methods

7.3.1 Power Consumption

- a) Set up the equipment as shown in Fig. 1.
- b) Terminate the booster by its output impedance 300/75 ohms as the case may be.
- c) Switch on and adjust the variac so that the voltmeter reads 240 V.
- d) Adjust the gain control on the power supply for full gain position.
- e) Take the reading on the ammeter (I).
- f) The power consumption is equal to $240 \times I$ (VA).

In case of a booster requiring external direct current supply, replace the supply source by a suitable stabilized direct current supply, the voltage and current should be suitable for direct current operation.

7.3.2 Frequency Range

- a) Set up equipment as shown in Fig. 2.
- b) Keep switch S_1 and S_2 on (a) position and adjust attenuator to get 1 mV (pp) on the monitor scope.
- c) Switch S_1 and S_2 to position (b) and sweep generator on full sweep; measure output pattern with the help of frequency marker at frequencies at which it falls by 3 dB of the maximum gain (Gain control of booster shall be at maximum position during the measurements).

7.3.3 Power Gain

- a) Set up equipment as shown in Fig. 3.
- b) Adjust attenuator to read 10 mV (pp) on the monitor scope with S_1 and S_2 in position (a). Note reading of attenuator as A_1 .
- c) Change S_1 , S_2 to position (b).
- d) Adjust attenuator to get 10 mV (pp) again, reading of attenuator now is A_2 .
- e) ($A_2 - A_1$) gives the gain of the booster (Booster in full gain position).

7.3.4 Maximum Output Level

- a) Connect set up as shown in Fig. 4.
- b) Set the frequency of generator at which maximum output level is to be measured.
- c) Increase the input level to the booster, by reducing attenuation till the level on the meter does not increase further by reducing attenuation in steps of 1 dB.
- d) Select a proper scale on the power meter to read the value of power directly in dB m and compute.

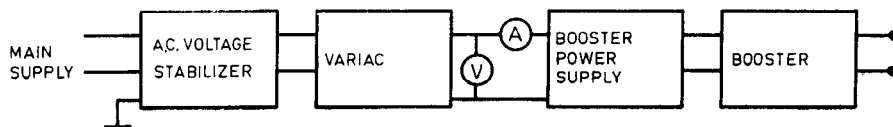


FIG. 1 TEST SET UP FOR POWER CONSUMPTION

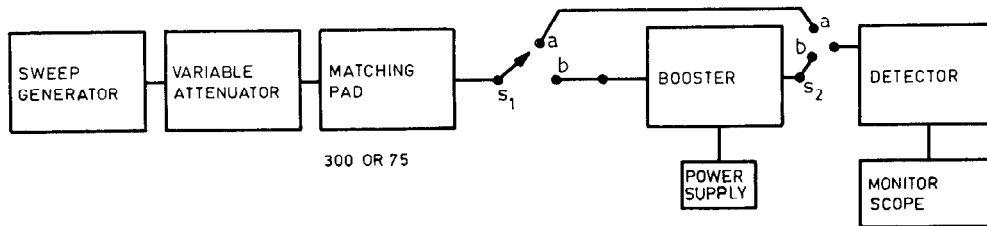


FIG. 2 TEST SET UP FOR FREQUENCY RANGE

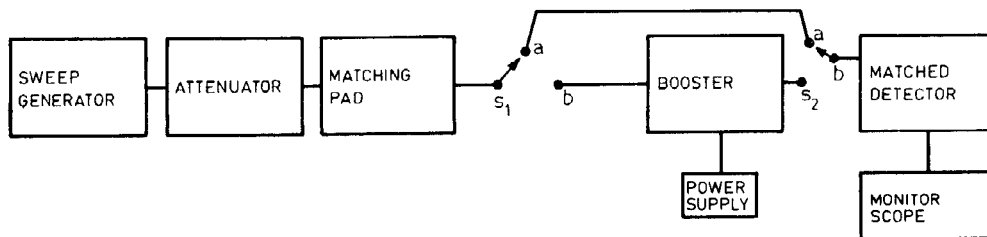


FIG. 3 TEST SET UP FOR POWER GAIN

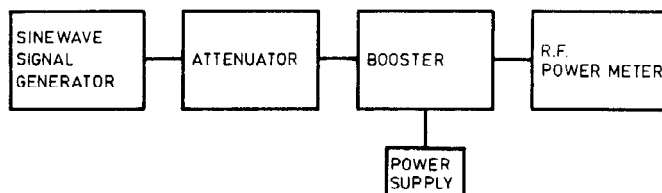


FIG. 4 TEST SET UP FOR MAXIMUM OUTPUT LEVEL

7.3.5 Noise Figure

- Set up the equipment as shown in Fig. 5.
- Set the frequency of the noise meter on which it is to be measured.
- Read noise directly on the noise figure meter in dB.

7.3.6 Voltage Standing Wave Ratio (VSWR)

7.3.6.1 The test set up shall be as shown in Fig. 6. Energize the tuner with proper power supply. Automatic Gain Control voltage is set for maximum gain. Terminate the booster with its output impedance.

7.3.6.2 For a particular channel, tune the signal generator to the mid channel frequency.

7.3.6.3 Set the generator reading at some known attenuation.

7.3.6.4 Open point A and note reference reading on the scope.

7.3.6.5 Connect the booster through point A and reduce attenuation in the scope to get the same reading on the scope.

7.3.6.6 Calculate the VSWR from the formulae:

$$VSWR = \frac{X+1}{X-1}$$

where X is the absolute change of attenuator reading between 7.3.6.4 and 7.3.6.5.

7.3.7 Gain Stability

- The test set up is shown in Fig. 7.
- Terminate the booster by its input impedance.
- Connect oscilloscope to the output of the booster after terminating the booster by its output impedance.
- Keep the oscilloscope vertical amplifier in its maximum sensitive position.
- Vary the gain control of the booster from minimum to maximum. There should be no output seen on the oscilloscope except for noise.

8 OPERATING AND INSTRUCTION MANUAL

8.1 An operating and instruction manual containing information relating to installation, operation, routine maintenance and safety precaution shall be made available with each booster.

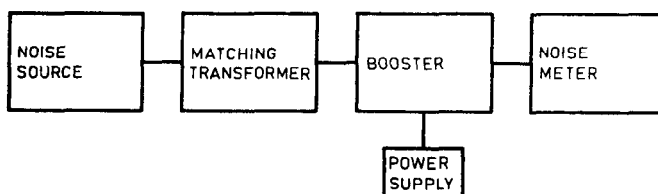


FIG. 5 TEST SET UP FOR NOISE FIGURE

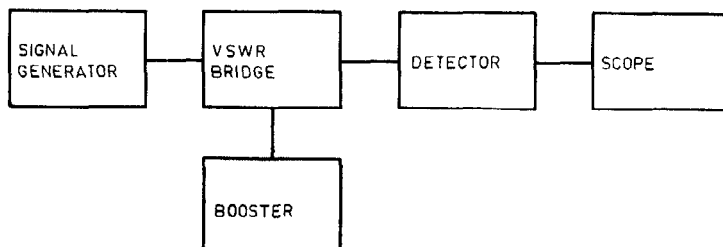


FIG. 6 TEST SET UP FOR VOLTAGE STANDING WAVE RATIO MEASUREMENT

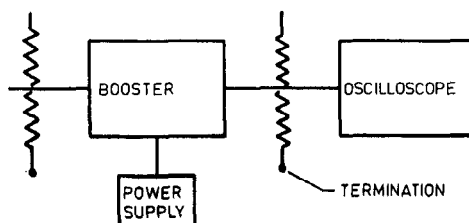


FIG. 7 TEST SET UP FOR GAIN STABILITY

ANNEX A

(Clause 2.1)

LIST OF REFERRED INDIAN STANDARDS

IS No.	Title	IS No.	Title
616 : 1986 (IEC Pub 65-1985)	Safety requirements for mains operated electronic and related apparatus for household and similar general use (<i>second revision</i>)	(Part 3/ Sec 5) : 1977	Dry heat test, Section 5 Dry heat test for heat dissipating items with gradual change of temperature
1885 (Part 3/ Sec 2) : 1966	Electrotechnical vocabulary : Part 3 Acoustics, Section 2 Acoustical and electro-acoustical system	(Part 5/ Sec 1) : 1981	Damp heat (cyclic) test, Section 1 16 + 8 h cycle
4905 : 1968	Methods for random sampling	(Part 7/ Sec 2) : 1979	Impact test, Section 2 Bump
6700 : 1972	Requirements for general purpose cathode-ray oscilloscope	(Part 7/ Sec 3) : 1979	Impact test, Section 3 Drop and topple
9000	Basic environmental testing procedures for electronic and electrical items:	(Part 8) : 1981	Vibration (sinusoidal) test
(Part 1) : 1988	General (<i>first revision</i>)	(Part 12) : 1981	Dust test
(Part 2/ Sec 4) : 1977	Cold test, Section 4 Cold test for heat dissipating items with gradual change of temperature	(Part 14/ Sec 1) : 1988	Test N : Change of temperature, Section 1 Test Na: Rapid change of temperature (thermal shock) with prescribed time of transition-Two chamber method (<i>first revision</i>)
		(Part 16) : 1983	Driving rain test

ANNEX B
(Clause 7.1.3)

RECOMMENDED LIST OF EQUIPMENT REQUIRED FOR TESTING THE
TELEVISION SIGNAL BOOSTER

Sweep signal generator	—
Oscilloscope	See IS 6700 : 1972
VSWR meter	—
Power supply	—
Noise measuring equipment	—
300 Matching transformer	—
Equipment for vibration test	See IS 9002 (Part 5) : 1979
Bump test machine	See IS 9002 (Part 7) : 1983
Chamber for dry heat test	See IS 9002 (Part 2) : 1977
Chamber for cold test	See IS 9002 (Part 1) : 1977
Humidity chamber	See IS 9002 (Part 3) : 1979
Chamber for salt mist	—
Dust chamber	See IS 9002 (Part 8) : 1984

ANNEX C
(Clause 7.2.3.1)

SAMPLING AND CRITERIA FOR CONFORMITY

C-1 LOT

C-1.1 All the boosters of the same model and type having the same design and manufactured by the same technique under essentially similar conditions of production shall constitute a lot.

C-1.1.1 Samples shall be taken and tested to ascertain the conformity of each lot for acceptance tests.

C-2 SCALE OF SAMPLING

C-2.1 Boosters shall be taken at random according to col 1, 2 and 3 of Table 4 (see also IS 4905 : 1968).

C-3 NUMBER OF TESTS AND CRITERIA
FOR CONFORMITY

C-3.1 Boosters shall be drawn from each lot

according to col 1 and 2 of Table 4 and subjected to the acceptance test specified in 7.2.3. If a booster fails in any one of the acceptance tests, it shall be called a defective. If the number of defectives found in the first sample (see col 1) is zero (see col 4), the lot shall be considered as conforming to the acceptance tests. If the number of defectives is equal to or greater than two (see col 5), the lot shall be considered as not conforming to the acceptance tests.

C-3.2 If the number of defectives is equal to one, further sample of boosters shall be taken according to col 2 of Table 4 and tested for all the acceptance tests. If the number of defectives in the combined sample (see col 3) is less than two (see col 5), the lot shall be considered as conforming to the acceptance tests, otherwise rejected.

Table 4 Scale of Sampling and Criteria for Conformity
(Clauses C-2.1, C-3.1 and C-3.2)

Lot Size	First Sample (N_1)	Second Sample (N_2)	Combined Sample ($N_1 + N_2$)	Acceptance Number	Rejection Number
(1)	(2)	(3)	(4)	(5)	(6)
Up to 150	5	5	10	0	2
151 to 300	8	8	16	0	2
301 and above	13	13	26	0	2

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